INTERNATIONAL STANDARD

ISO 29463-3

First edition
2011-10-15

High-efficiency filters and filter media for removing particles in air —

Part 3: Testing flat sheet filter media

Filtres à haut rendement et filtres pour l'élimination des particules dans l'air —

Partie 3: Méthode d'essai des filtres à feuille plate

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 29463-3:2011
https://standards.iteh.ai/catalog/standards/sist/20dc55e4-480d-4d45-9b37-6fbb72256b3d/iso-29463-3-2011

Reference number
ISO 29463-3:2011(E)

© ISO 2011

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 29463-3:2011
https://standards.iteh.ai/catalog/standards/sist/20dc55e4-480d-4d45-9b37-6fbb72256b3d/iso-29463-3-2011

COPYRIGHT PROTECTED DOCUMENT

© ISO 2011

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 29463-3:2011
https://standards.iteh.ai/catalog/standards/sist/20dc55e4-480d-4d45-9b37-6fbb72256b3d/iso-29463-3-2011

© ISO 2011 – All rights reserved

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 29463-3 was prepared by Technical Committee ISO/TC 142, *Cleaning equipment for air and other gases*.

ISO 29463 consists of the following parts, under the general title *High-efficiency filters and filter media for removing particles in air*:

iTeh STANDARD PREVIEW
(standards.iteh.ai)

— *Part 1: Classification, performance, testing and marking*

ISO 29463-3:2011
https://standards.iteh.ai/catalog/standards/sist/20dc55e4-480d-4d45-9b37-6fbb72256b3d/iso-29463-3-2011

— *Part 2: Aerosol production, measuring equipment, particle-counting statistics*

— *Part 3: Testing flat sheet filter media*

— *Part 4: Test method for determining leakage of filter element — Scan method*

— *Part 5: Test method for filter elements*

© ISO 2011 – All rights reserved

Introduction

ISO 29463 (all parts) is derived from EN 1822 (all parts) with extensive changes to meet the requests from non-EU p-members. It contains requirements, fundamental principles of testing and the marking for high-efficiency particulate air filters with efficiencies from 95 % to 99,999 995 % that can be used for classifying filters in general or for specific use by agreement between users and suppliers.

ISO 29463 (all parts) establishes a procedure for the determination of the efficiency of all filters on the basis of a particle counting method using a liquid (or alternatively a solid) test aerosol, and allows a standardized classification of these filters in terms of their efficiency, both local and overall efficiency, which actually covers most requirements of different applications. The difference between ISO 29463 (all parts) and other national standards lies in the technique used for the determination of the overall efficiency. Instead of mass relationships or total concentrations, this technique is based on particle counting at the most penetrating particle size (MPPS), which, for micro-glass filter mediums, is usually in the range of 0,12 µm to 0,25 µm. This method also allows testing ultra-low penetration air filters, which was not possible with the previous test methods because of their inadequate sensitivity. For membrane filter media, separate rules apply, and they are described in ISO 29463-5:2011, Annex B. Although no equivalent test procedures for testing filters with charged media is prescribed, a method for dealing with these types of filters is described in ISO 29463-5:2011, Annex C. Specific requirements for test method, frequency, and reporting requirements can be modified by agreement between supplier and customer. For lower efficiency filters (group H, as described below), alternate leak test methods described in ISO 29463-4:2011, Annex A can be used by specific agreement between users and suppliers, but only if the use of these other methods is clearly designated in the filter markings as described in ISO 29463-4:2011, Annex A.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

There are differences between ISO 29463 (all parts) and other normative practices common in several countries. For example, many of these rely on total aerosol concentrations rather than individual particles. For information, a brief summary of these methods and their reference standards are provided in ISO 29463-5:2011, Annex A.

ISO 29463-3:2011
https://standards.iteh.ai/catalog/standards/sist/20dc55e4-480d-4d45-9b37-6fbb72256b3d/iso-29463-3-2011

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 29463-3:2011
https://standards.iteh.ai/catalog/standards/sist/20dc55e4-480d-4d45-9b37-6fbb72256b3d/iso-29463-3-2011

High-efficiency filters and filter media for removing particles in air —

Part 3: Testing flat sheet filter media

1 Scope

This part of ISO 29463 specifies the test procedure for testing the efficiency of flat sheet filter media. It is intended for use in conjunction with ISO 29463-1, ISO 29463-2, ISO 29463-4 and ISO 29463-5.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 29463-3:2011
https://standards.iteh.ai/catalog/standards/sist/20dc55e4-480d-4d45-9b37-
0f807225083d/iso-29463-3-2011

ISO 29463-1:2011, *High-efficiency filters and filter media for removing particles in air — Part 1: Classification, performance, testing and marking*

ISO 29463-2:2011, *High-efficiency filters and filter media for removing particles in air — Part 2: Aerosol production, measuring equipment, particle-counting statistics*

ISO 29463-4:2011, *High-efficiency filters and filter media for removing particles in air — Part 4: Test method for determining leakage of filter element — Scan method*

ISO 29463-5:2011, *High-efficiency filters and filter media for removing particles in air — Part 5: Test method for filter elements*

ISO 29464[1)], *Cleaning equipment for air and other gases — Terminology*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 29463-1, ISO 29463-2 and ISO 29464 apply.

4 Symbols and abbreviations

Table 1 presents the quantities (terms and symbols) used in this part of ISO 29463 to represent measurement variables and calculated values. The values should be inserted in the equation given for these calculations in the units specified.

1) To be published.

© ISO 2011 – All rights reserved

Table 1 — Quantities, symbols and units

Term	Symbol	Unit	Equation for the calculation
Measured variables			
Exposed area	A	cm^2	
Test volume flow rate	$\dot{V}$	cm^3/s	
Pressure drop	Δp	Pa	
Mean particle diameter	$\bar{d}_p$	µm	
Particle number	N	—	
Sampling volume flow rate	$\dot{V}_s$	cm^3/s	
Sampling duration	t	s	
Calculated quantities			
Filter medium face velocity	u	cm/s	$u = \frac{V}{A}$
Mean differential pressure	$\Delta\bar{p}$	Pa	$\Delta\bar{p} = \frac{1}{n}\sum_{i=1}^{n}\Delta\bar{p}_i$
Particle number concentration	c_N	cm^{-3}	$c_N = \frac{N}{\dot{V}_s \cdot t}$
Penetration for particles in size range i	P_i	[a]	$P_i = \frac{c_{N,d,i}}{c_{N,u,i}}$ [b]
Mean penetration	$\bar{P}$	[a]	$\bar{P} = \frac{1}{n}\sum_{i=1}^{n}P_i$
Mean efficiency	$\bar{E}$	[a]	$\bar{E} = 1 - \bar{P}$
Number of particles for the upper or lower limit of the 95 % level of confidence	$N_{95\,\%}$	—	ISO 29463-2:2011, Clause 7
Penetration as upper limit value for the 95 % level of confidence	$P_{95\,\%,i}$	[a]	$P_{95\,\%,i} = \frac{c_{N,d,95\,\%,i}}{c_{N,u,95\,\%,i}}$ [b]
Mean penetration as upper limit value for the 95 % level of confidence	$\bar{P}_{95\,\%}$	[a]	$\bar{P}_{95\,\%} = \frac{1}{n}\sum_{i=1}^{n}P_{95\,\%,i}$
Mean efficiency as lower limit value for the 95 % level of confidence	$\bar{E}_{95\,\%}$	[a]	$\bar{E}_{95\,\%} = 1 - \bar{P}_{95\,\%}$

[a] These quantities are usually given as a percentage.

[b] The index, u, refers to upstream particle counts, and the index, d, refers to downstream particle counts.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 29463-3:2011
https://standards.iteh.ai/catalog/standards/sist/20dc55e4-480d-4d45-9b37-6fbb72256b3d/iso-29463-3-2011

© ISO 2011 – All rights reserved

5 Principle

When testing the sheet filter medium, the particle size efficiency is determined using a particle counting method. The testing may use a mono-disperse or a poly-disperse test aerosol. The methods differ in terms of both the production of the aerosol and the particle counter used. Furthermore, the measurement of the pressure drop is made at the prescribed filter medium velocity.

Specimens of the sheet filter medium are fixed in a test filter assembly and subjected to the test air flow corresponding to the prescribed filter medium velocity. The test aerosol from the aerosol generator is conditioned (e.g. vaporization of a solvent), then neutralized, mixed homogeneously with filtered test air and directed to the test filter assembly.

In order to determine the efficiency, partial flows of the test aerosol are sampled upstream and downstream of the filter medium. Using a particle counting instrument, the number concentration of the particles contained is determined for various particle sizes. The results of these measurements are used to draw a graph of efficiency against particle size for the filter medium, and to determine the particle size for which the efficiency is a minimum. This particle size is known as the most penetrating particle size (MPPS).

When measuring the particles on the upstream side of the filter medium, it can be necessary to use a dilution system in order to reduce the concentration of particles down to the measuring range of the particle counter used.

Additional equipment is required to measure the absolute pressure, temperature and relative humidity of the test aerosol and to measure and control the test volume flow rate.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

6 Sampling of sheet filter media

The testing of the sheet filter medium shall be carried out on at least five samples.

ISO 29463-3:2011
https://standards.iteh.ai/catalog/standards/sist/29d45541-80d-4d45-9b37-6fbb72256b3d/iso-29463-3-2011

The samples shall be handled with care; the area being tested shall be free from all folds, kinks, holes or other irregularities.

All samples shall be clearly and permanently marked with the following details:

a) designation of the filter medium;

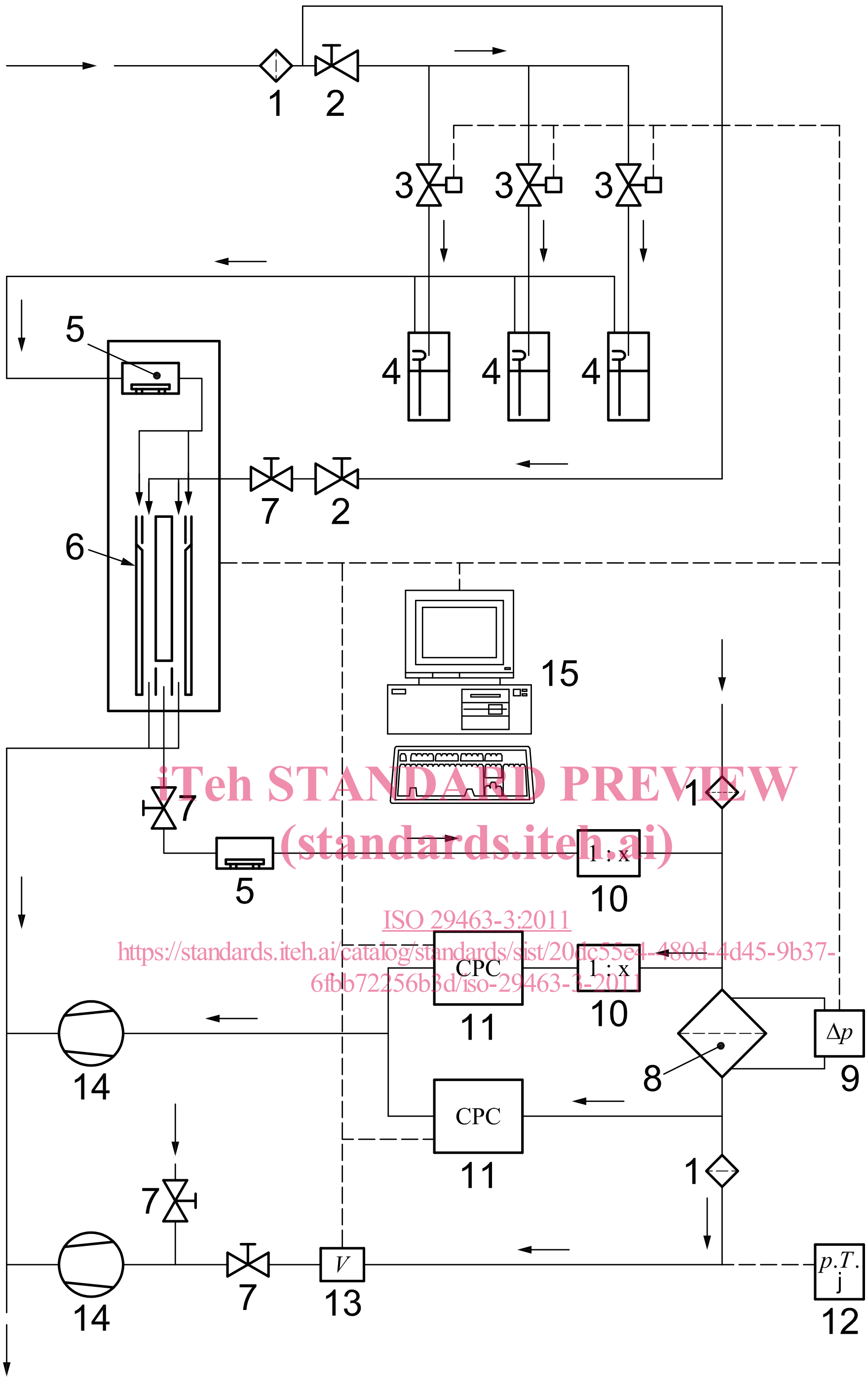
b) upstream side of the filter medium.

7 Test apparatus

The test apparatus being used and the arrangement of the components and measuring equipment are shown in Figure 1.

The basic details for the aerosol generation and the aerosol neutralization, together with the details of suitable types of apparatus, are given in ISO 29463-2.

© ISO 2011 – All rights reserved



iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 29463-3:2011
https://standards.iteh.ai/catalog/standards/sist/20dc55e4-480d-4d45-9b37-6fbb72256b3d/iso-29463-3-2011

Key

1 filter
2 pressure valve
3 solenoid valve
4 jet nebulizer
5 neutralizer
6 differential mobility analyser
7 needle valve
8 test filter mounting assembly
9 differential pressure gauge
10 dilution system
11 condensation particle counter
12 measuring equipment for absolute pressure, temperature and relative humidity
13 volume flow rate meter
14 vacuum pump
15 computer for control and data storage

Figure 1 — Set-up for testing with mono-disperse test aerosols

© ISO 2011 – All rights reserved

7.1 Test arrangements for testing with mono-disperse test aerosol

When testing sheet filter media with a mono-disperse test aerosol, the particle number concentration is determined using a total count method with a condensation particle counter. The arrangement of the test apparatus is shown in Figure 1.

The mono-disperse test aerosol is created in a number of steps. Firstly, a poly-disperse primary aerosol is produced using a jet nebulizer with, for example, a DEHS- or DOP-iso-propanol solution. The particles are reduced to a convenient size for the following process by evaporation of the solvent. The aerosol is then neutralized and passed to a differential mobility analyser. The quasi-mono-disperse test aerosol available at the output of the differential mobility analyser is once again neutralized, and then mixed homogeneously with filtered test air in order to achieve at the test volume flow rate required for the filter medium velocity.

The mean particle diameter of the number distribution is varied by adjusting the voltage between the electrodes of the differential mobility analyser[2)].

In order to achieve a sufficiently high particle number concentration over the entire test range from 0,04 µm to 0,8 µm, it can prove necessary to use several jet nebulizers with differing concentrations of the aerosol substances in the solvent. Numerical concentrations that are too high can be adjusted by diluting the test aerosol before the test filter mounting assembly. The number concentration in the test aerosol shall be selected so that no dilution is necessary for the measurements made downstream from the filter.

A pump positioned downstream draws the test aerosol through the test filter mounting assembly. This ensures that the differential mobility analyser can always operate under nearly the same conditions, independent of the pressure drop across the tested filter medium. In contrast, the testing system operates with an overpressure, which ensures that leaks in the system do not falsify the test measurements.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Particles are counted upstream and downstream from the filter using either two condensation particle counters in parallel, or using only one such counter to measure the upstream and downstream concentrations alternately. If the level of the upstream number concentration exceeds the measuring range of the counter, then a dilution system shall be included between the sampling point and the counter.

ISO 29463-3:2011
https://standards.iteh.ai/catalog/standards/sist/20dc55e4-480d-4d45-9b37-6fbb72256b3d/iso-29463-3-2011

7.2 Test arrangements for testing with a poly-disperse test aerosol

When testing sheet filter media with a poly-disperse test aerosol, optical particle counters that determine the number distribution and the number concentration of the test aerosol are used.

The tests can be carried out directly with the poly-disperse, neutralized primary aerosol. In order to cover the test range, it can be necessary to use several jet nebulizers with different concentrations of the aerosol substance in the solvent. The mean particle diameter of the number distribution shall not lie outside the test range of the particle counter used.

The arrangement of the test apparatus is shown in Figure 2. Instead of the single or two parallel condensation particle counters (CPC), optical particle counters are used to determine the number distribution and the number concentration of the poly-disperse test aerosol on the upstream and downstream sides of the filter medium.

When testing with a poly-disperse test aerosol and particle counting and sizing equipment, it is also necessary to ensure that the number concentration of the test aerosol is adjusted to suit the measuring range of the particle counter, if necessary by the inclusion of a dilution system.

2) The adjustment gives the mode of number distribution. This can be taken as equal to the median value with sufficient accuracy.

© ISO 2011 – All rights reserved